CLAIMS TO INVENTION:

1. A system for illuminating an object and forming an image thereof, comprising:

an image formation and detection module having a field of view (FOV) focused at an image detecting array; and

a planar laser illumination array for producing a planar laser illumination beam having substantially-planar spatial distribution characteristics that extend through the field of view (FOV) of said image formation and detection module, so that laser light reflected off an object illuminated by said planar laser illumination beam is focused along said field of view and onto said image detecting array to form an image of said illuminated object.

2. The system of claim 1, wherein said planar laser illumination beam array comprises an plurality of planar laser illumination modules, wherein each said planar laser illumination module comprises a visible laser diode (VLD), a focusing lens, and a cylindrical optical element arranged therewith to produce a planar laser illumination beam component.

3. The system of claim 2, wherein the individual planar laser illumination beam components produced from said plurality of planar laser illumination modules are optically combined to produce a composite substantially planar laser illumination beam having substantially uniform power density characteristics over the entire spatial extend thereof and thus the working range of the system.

4. The system of claim 3, wherein each planar laser illumination beam component is focused so that the minimum beam width thereof occurs at a point or plane which is the farthest or maximum object distance at which the system is designed to acquire images, thereby compensating for decreases in the power density of the incident planar laser illumination beam due to the fact that the width of the planar laser illumination beam increases in length for increasing object distances away from the imaging optics.

5. A method of illuminating an object and forming an image thereof, comprising the steps of:

(a) providing a field of view (FOV) focused at an image detecting array; and

(b) producing a planar laser illumination beam having substantially-planar spatial distribution characteristics that extend through said field of view (FOV) so that laser light reflected off an object illuminated by said planar laser illumination beam is focused along said field of view and onto said image detecting array to form an image of said illuminated object.

6. The method of claim 5, wherein said step (b) comprise:

producing a plurality of laser beams from a plurality of visible laser diodes (VLDs);

focusing each said laser beam through a focusing lens, and

expanding the focused laser beam through a cylindrical optical element so as to produce a substantially planar laser illumination beam component;

optically combining the plurality of planar laser illumination beam components produce a composite substantially planar laser illumination beam having substantially uniform power density characteristics over the entire spatial extend thereof and thus the working range of the system.

7. The method of claim 6, wherein each planar laser illumination beam component is focused so that the minimum beam width thereof occurs at a point or plane which is the farthest or maximum object distance at which the system is designed to acquire images, thereby compensating for decreases in the power density of the incident planar laser illumination beam due to the fact that the width of the planar laser illumination beam increases in length for increasing object distances away from the imaging optics.

8. A system for illuminating the surface of objects using a linear array of laser light emitting devices configured together to produce a substantially planar beam of laser illumination which extends in substantially the same plane as the field of view of the linear array of electronic image detection cells of the system, along at least a portion of its optical path within its working distance,

9. The system of claim 8, wherein the linear array of electronic image detection cells are realized using charge-coupled device (CCD) technology.

10. A system for producing digital images of objects using a visible laser diode array for producing a planar laser illumination beam for illuminating the surfaces of such objects, and also an electronic image detection array for detecting laser light reflected off the illuminated objects during illumination and imaging operations.

11. A system for illuminating the surfaces of object to be imaged, using an array of planar laser illumination arrays which employ VLDs that are smaller, and cheaper, run cooler, draw less power, have longer lifetimes, and require simpler optics (because their frequency bandwidths are very small compared to the entire spectrum of visible light).

12. A system for illuminating the surfaces of objects to be imaged, wherein the VLD concentrates all of its output power into a thin laser beam illumination plane which spatially coincides exactly with the field of view of the imaging optics of the system, so very little light energy is wasted.

13. A laser illumination and imaging system, wherein the working distance of the system can be easily extended by simply changing the beam focusing and imaging optics, and without increasing the output power of the visible laser diode (VLD) sources employed therein.

14. A laser illumination and imaging system, wherein each planar laser illumination beam is focused so that the minimum width thereof (e.g. along its non-spreading direction) occurs at a

point or plane which is the farthest object distance at which the system is designed to capture images.

15. A laser illumination and imaging system, wherein a fixed focal length imaging subsystem is employed, and the laser beam focusing technique of the present invention helps compensate for decreases in the power density of the incident planar illumination beam due to the fact that the width of the planar laser illumination beam for increases increasing distances away from the imaging subsystem.

16. A laser illumination and imaging system, wherein a variable focal length (i.e. zoom) imaging subsystem is employed, and the laser beam focusing technique of the present invention helps compensate for (i) decreases in the power density of the incident illumination beam due to the fact that the width of the planar laser illumination beam (i.e. beamwidth) along the direction of the beam's planar extent increases for increasing distances away from the imaging subsystem, and (ii) any $1/r^2$ type losses that would typically occur when using the planar laser illumination beam.

17. A laser illumination and imaging system, wherein scanned objects need only be illuminated along a single plane which is coplanar with a planar section of the field of view of the image formation and detection module being used in the system.

18. A laser illumination and imaging system, wherein low-power, light-weight, high-response, ultra-compact, high-efficiency solid-state illumination producing devices, such as visible laser diodes (VLDs), are used to selectively illuminate ultra-narrow sections of a target object during image formation and detection operations, in contrast with high-power, low-response, heavy-weight, bulky, low-efficiency lighting equipment (e.g. sodium vapor lights) required by prior art illumination and image detection systems.

19. A laser illumination and imaging system, wherein the planar laser illumination technique of the present invention enables high-speed modulation of the planar laser illumination beam, and use of simple (i.e. substantially monochromatic) lens designs for substantially monochromatic optical illumination and image formation and detection operations.

20. A laser illumination and imaging system, wherein special measures are undertaken to ensure that (i) a minimum safe distance is maintained between the VLDs in each PLIM and the user's eyes using a light shield, and (ii) the planar laser illumination beam is prevented from directly scattering into the FOV of the image formation and detection module, from within the system housing.

21. A laser illumination and imaging system, wherein the planar laser illumination beam and the field of view of the image formation and detection module do not overlap on any optical surface within the PLIIM system.

22. A laser illumination and imaging system, wherein the planar laser illumination beams are permitted to spatially overlap with the FOV of the imaging lens of the system only outside of the system housing, measured at a particular point beyond the light transmission window, through which the FOV is projected.

23. A laser illumination and substantially-monochromatic imaging system, wherein the planar laser illumination arrays (PLIAs) and the image formation and detection (IFD) module are mounted in strict optical alignment on an optical bench such that there is no relative motion, caused by vibration or temperature changes, is permitted between the imaging lens within the IFD module and the VLD/cylindrical lens assemblies within the PLIAs.

24. A laser illumination and substantially-monochromatic imaging system, wherein the imaging module is realized as a photographic image recording module.

25. A laser illumination and substantially-monochromatic imaging system, wherein the imaging module is realized as an array of electronic image detection cells having short integration time settings for high-speed image capture operations.

26. A laser illumination and substantially-monochromatic imaging system, wherein a pair of planar laser illumination arrays are mounted about an image formation and detection module having a field of view, so as to produce a substantially planar laser illumination beam which is coplanar with the field of view during object illumination and imaging operations.

27. A laser illumination and monochromatic imaging system, wherein an image formation and detection module projects a field of view through a first light transmission aperture formed in the system housing, and a pair of planar laser illumination arrays project a pair of planar laser illumination beams through second set of light transmission apertures which are optically isolated from the first light transmission aperture to prevent laser beam scattering within the housing of the system.

28. A laser illumination and substantially-monochromatic imaging system, the principle of Gaussian summation of light intensity distributions is employed to produce a planar laser illumination beam having a power density across the width the beam which is substantially the same for both far and near fields of the system.

29. A system for producing images of objects by focusing a planar laser illumination beam within the field of view of an imaging lens so that the minimum width thereof along its non-spreading direction occurs at the farthest object distance of the imaging lens.

30. A package dimensioning and identification system contained in a single housing of compact construction, wherein a planar laser illumination and monochromatic imaging subsystem is

integrated with a Laser Doppler Imaging and Profiling (LDIP) subsystem and contained within a single housing of compact construction.

31. A package dimensioning and identification system, wherein the system of claim 1projects a field of view through a first light transmission aperture formed in the system housing, and a pair of planar laser illumination beams through second and third light transmission apertures which are optically isolated from the first light transmission aperture to prevent laser beam scattering within the housing of the system, and the LDIP subsystem projects a pair of laser beams at different angles through a fourth light transmission aperture.

32. A package identification and measuring system, wherein an image-based scanning subsystem is used to read bar codes on packages passing below or near the system, while a package dimensioning subsystem is used to capture information about the package prior to being identified.